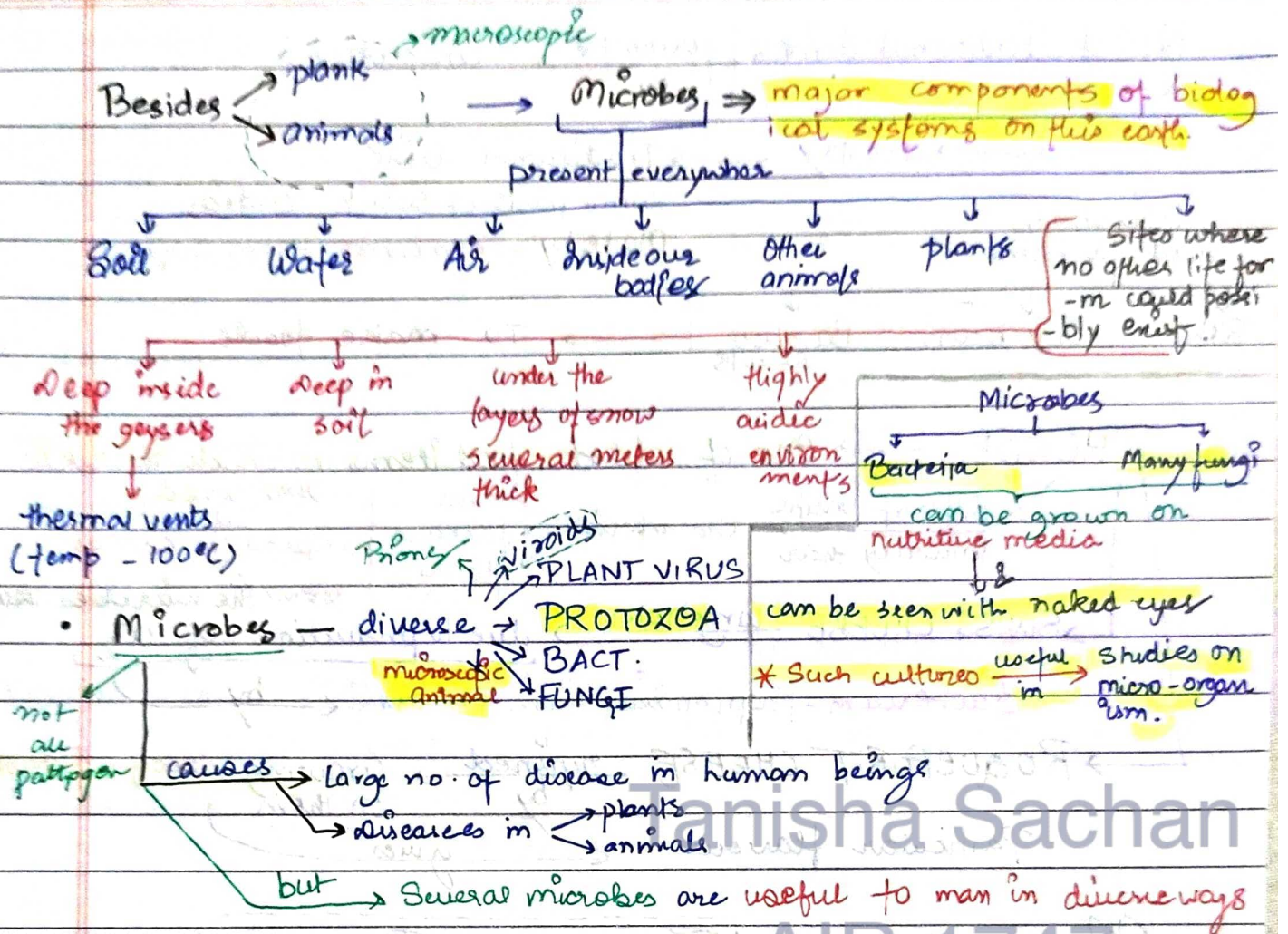


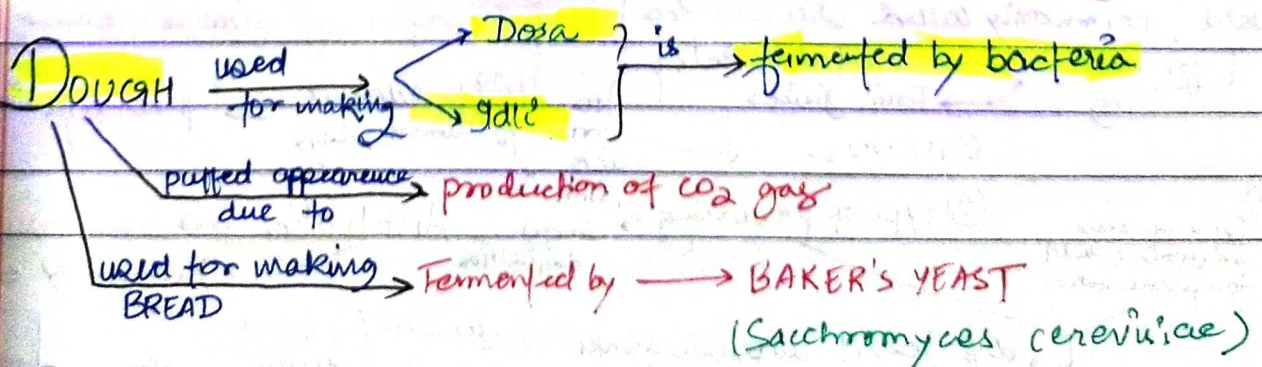
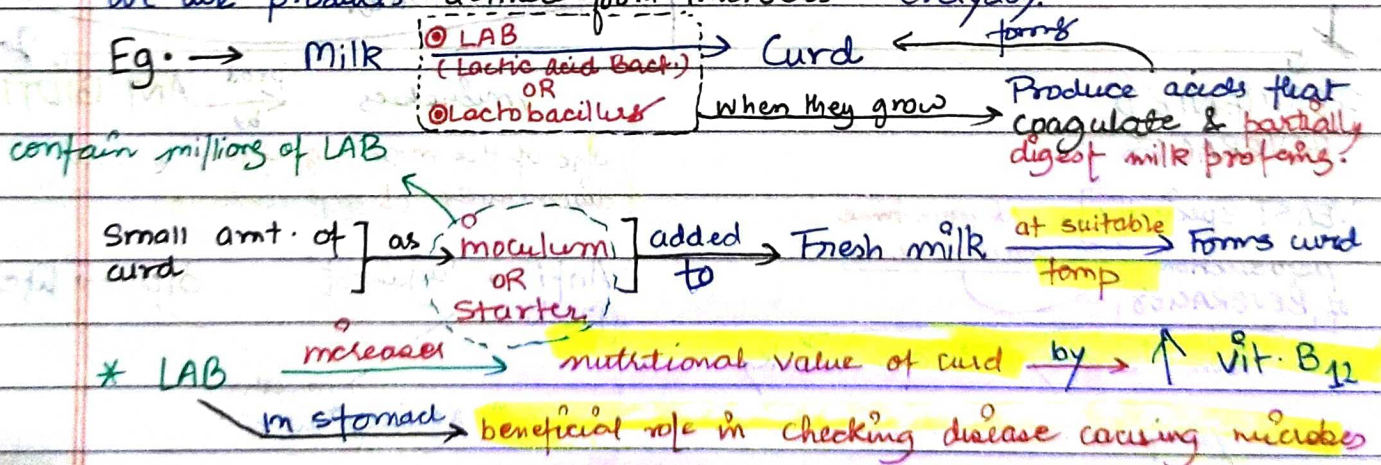
# 1 MICROBES in HUMAN WELFARE



## MICROBES IN HOUSEHOLD PRODUCTS

We use products - derived from microbes - everyday.

Eg.  $\rightarrow$  Milk





No. of Traditional drinks & foods } fermented by microbes

TODDY → Traditional drink  
some parts of South India  
Made by - Fermenting Palm sap

Microbes used to ferment

Fish Soyabean Bamboo Shoots } To make foods

CHEESE → One of oldest food items in which microbes were used.

different varieties known by their characteristic taste, texture, flavour } specificity comes from the microbes used

SWISS CHEESE large holes → due to production of  $CO_2$

Bacterium - *Propionibacterium Sharmmii* ← by

ROQUEFORT CHEESE ripened by growing specific Fungi on them

Particular flavour ← gives

## MICROBES IN INDUSTRIAL PRODUCTS

Production on industrial scale → requires growing microbes in very large vessel called FERMENTORS.

### 1. FERMENTED BEVERAGES

YEAST specially used from time immemorial for production of BEVERAGES

Wine Rum Brandy Beer Whisky

Same yeast → *Saccharomyces cerevisiae* used, commonly called brewer's yeast

for fermenting malted cereals, Fruit Juices

ETHANOL

to prod - uce

① Type of raw material used for fermentation

② Type of processing

with or without distillation

diff. types of alcoholic drinks are obtained.

microbes

prod by

### 2. ANTIBIOTICS

one of the most significant discoveries of 20th century

Anti greek

→ 'against'

Bio → 'life'

"against life"

in context of disease causing organism

With reference to human beings

→ "pro life"

Antibiotic

chemical subs

Produced by some microbes

to kill / retard growth of other microbes.



↑ out  
distillation → Wine  
→ Beer

★ Distillation of fermented broth.  
→ Whisky  
→ Brandy  
→ Rum.

### 3 CHEMICAL, ENZYMES & OTHER BIOACTIVE MOLECULES

organic acids   Alcohols   Enzymes } produced by microbes

#### • Acid Producers

- 1) Citric acid - *Aspergillus Niger* (Fungus)
- 2) Acetic acid - *Acetobacter aceti* (a bacterium)
- 3) Butyric acid - *Clostridium Butylici* - cum (a bacterium)
- 4) Lactic acid - *Lactobacillus* (a bacterium)

Yeast - *Saccharomyces cerevisiae*  
↓ used for production of  
**Ethanol.**

\* **Microbes are used in prod. of Enzymes**

• **Lipase** used for → Detergent formulations  
→ Removes oily stains from laundry

• **Pectinases + Proteases** used for → clearing bottled juices  
(Market bottled juices are dearer than home made)  
due to

• **Streptokinase** → By streptococcus bacterium  
modified by Genetic Engineering  
"Clot Busters" → removing clots from B.V of patient & who have undergone myocardial infarction

• **Bioactive Molecule** → Cyclosporin A → By fungi *Trichoderma Polysporum*  
heart attack leading to  
→ Immunosuppressive agent in organ transplant patients

**PENICILLIN** (antibiotic) → first antibiotic to be discovered  
Chance Discovery

Alexander Flemming working on *Staphylococci* bact.  
observed a mould growing in one of his unwatched culture around which *staphylococci* could not grow

↓ due to chemical prod. by a mould (*Penicillium notatum*)  
→ **PENICILLIN** named after the mould  
used extensively to treat american soldiers wounded in world war II.

Full potential as an antibiotic effectively established much later by  
① Ernest Chain   ② Howard Florey

→ Awarded noble prize - 1945 for discovery

After penicillin → other antibiotics were also purified from other microbes

Antibiotic helped greatly → improved our capacity to treat deadly disease as

↓  
Plague   Whooping Cough   Diphtheria   Leprosy  
↓   ↓   ↓   ↓  
Kali Khansi   Gal ghote   Kusht Rog  
→ used to kill millions all over globe

TANISHA SACHAN  
AIR 747  
NCERT THREAD NOTES



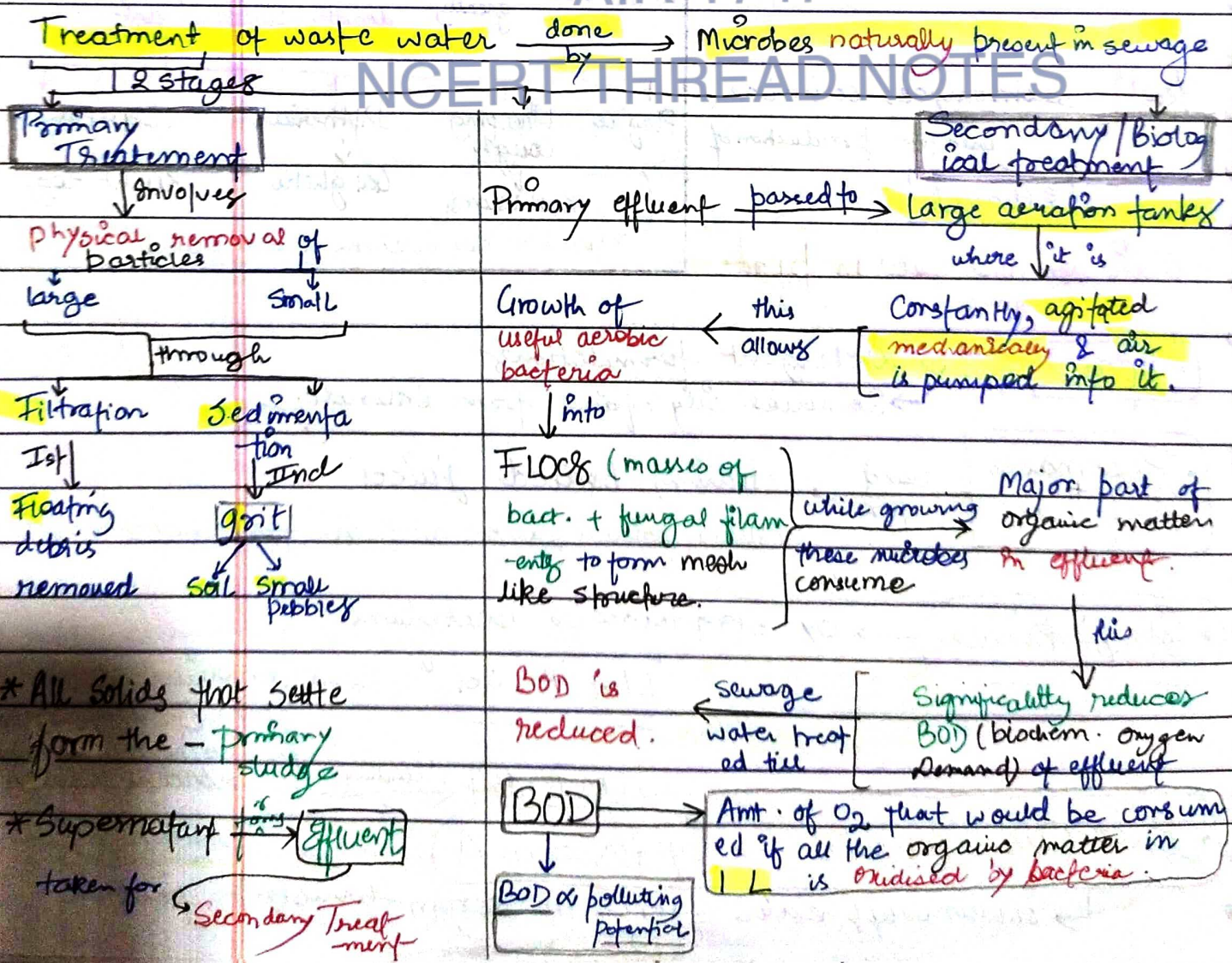
• Statins → produced by Yeast → Monascus Purpureus  
 ↓ commercialised Blood cholesterol lowering agents  
acts competitively → enzyme responsible for synthesis of cholesterol.  
Inhibiting

# MICROBES IN SEWAGE TREATMENT

Large quantities of waste water are generally generated everyday in city towns } major component of this waste water } Human Excreta.

\* Municipal waste water called → SEWAGE contains large amt. of organic matter } many of which are pathogenic microbes.  
 \* Sewage can't be disposed off directly into water bodies (Streams, River).  
 Before disposal → treated in (BTPs) → Sewage Treatment plants → To make sewage less polluting.

TANISHA SACHAN  
 AIR 1747  
 NCERT THREAD NOTES





BOD test  $\xrightarrow{\text{measuring}}$  Rate of uptake of  $O_2$  by micro-organisms in a sample of water, & thus BOD - indirect measure of organic matter present in water.

Once BOD of sewage water is reduced significantly.

the effluent passed to

Settling tanks

where

Bacterial flocs are allowed to sediment

Activated sludge

this sediment is called

Pumped back to its aeration tanks

A small part of it

remaining (major) part pumped to

to serve as Inoculum

Large tanks

Anaerobic Sludge Digesters

here

Other kinds of bacteria grow anaerobically

Bacteria produce a mixture of gases

during this digestion

in sludge

Bacteria & Fungi

digest

$H_2S$   $CH_4$   $CO_2$

form

BIOGAS

source of energy

bcz its inflammable

The effluent from Secondary Treatment plants

released into

Natural Water Bodies

Streams

Rivers

\* Till Date  $\xrightarrow{\text{man-}}$  no made technology has been able to rival the microbial treatment of sewage

\* Quantity of sewage is large (due to  $\uparrow$  urbanisation) > No. of sewage treatment plants

$\Downarrow$  hence

① Untreated sewage is often discharged directly into rivers leading to their pollution &  $\uparrow$  in water borne disease

\* Ministry of Environment & Forests has initiated

Ganga Action plan

Yamuna Action plan

Under these plans  $\downarrow$  proposed

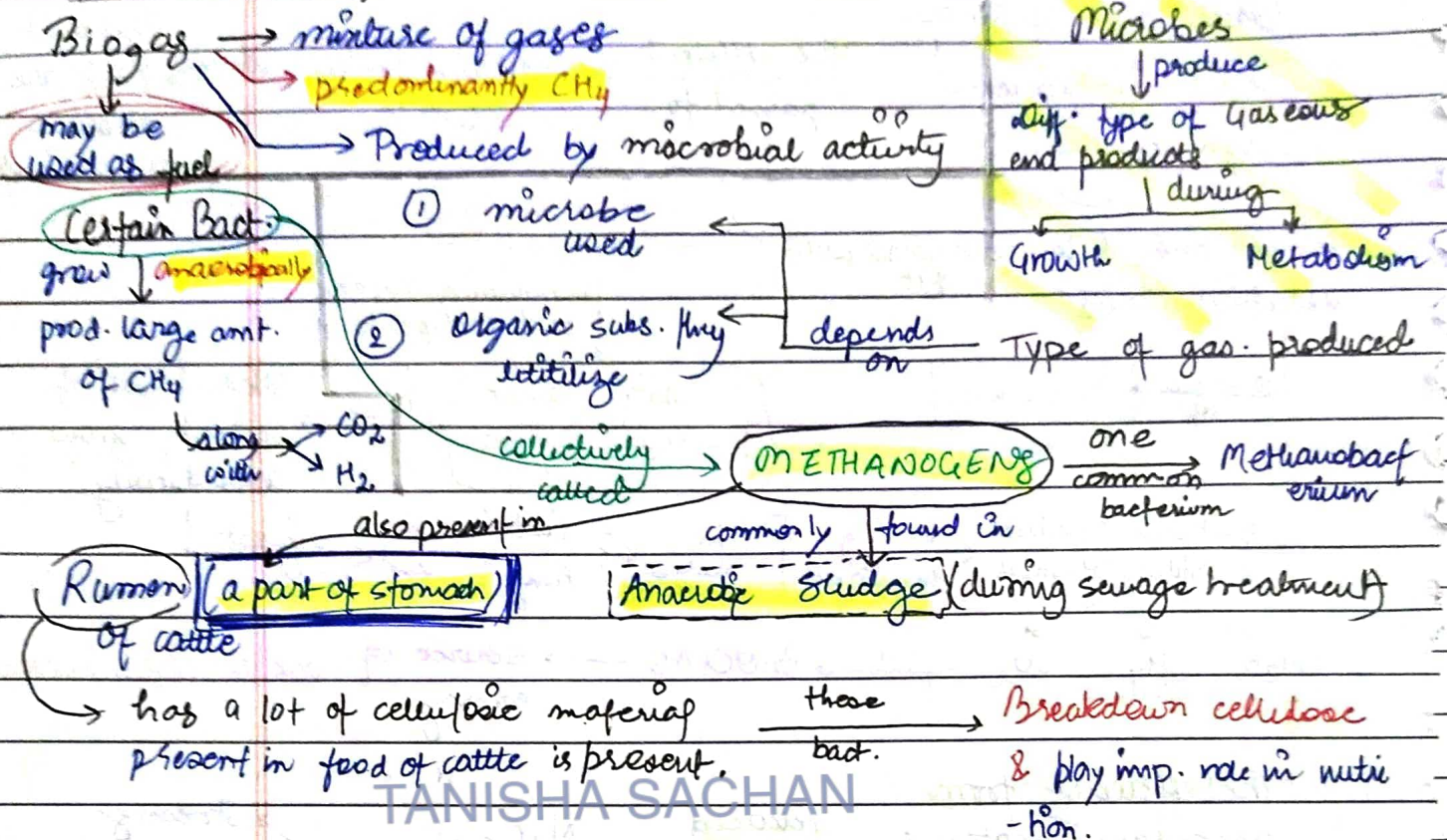
to build a large no. of sewage treatment plants so that only treated sewage is discharged into river

To save these major rivers of our country from pollution.



Methanogens produce biogas while degrading plant waste

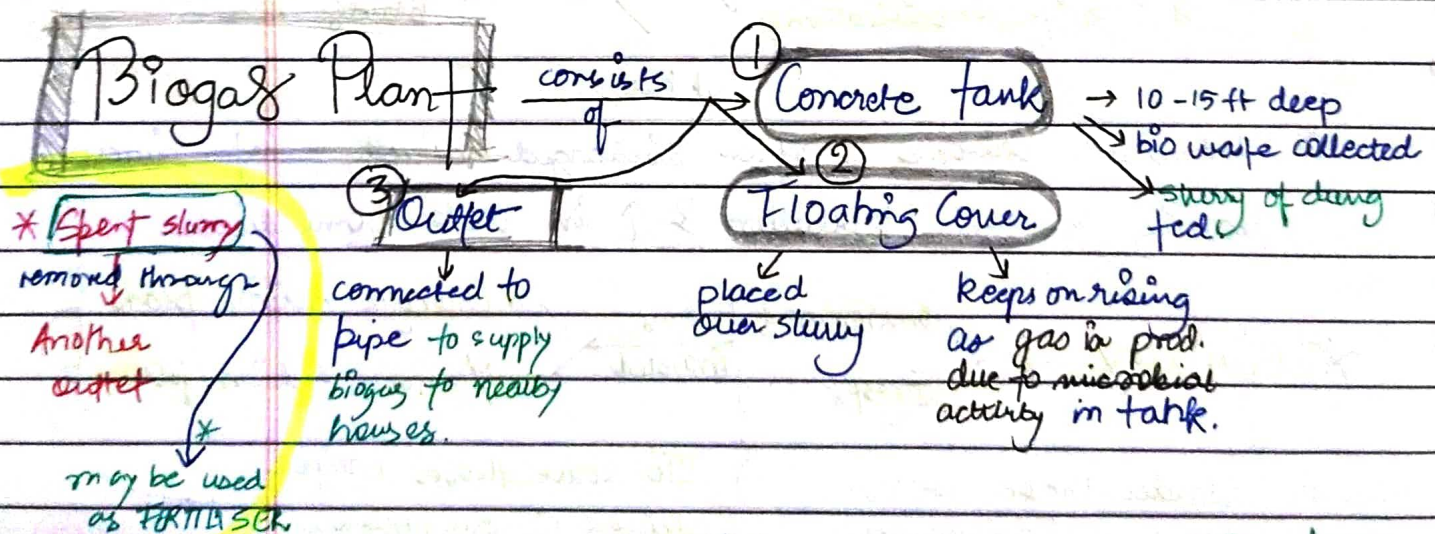
# MICROBES in PROD. OF BIOGAS



Humans — not able to digest cellulose bcz NO cellulase present.

## NCERT THREAD NOTES

Excreta of cattle → dung commonly called Gobar → rich in bacteria (methanogens)  
used for generation of Gobar Gas ← commonly called Biogas



\* Cattle dung → (large quantity) more available in Rural areas  
Biogas plants are more after built here.  
cattles here are used for variety of purposes



Biogas prod.  $\xrightarrow{\text{used for}}$   $\begin{cases} \text{cooking} \\ \text{lightening} \end{cases}$

\* Technology of Biogas production was developed in INDIA due to efforts of

IARI

Indian Agricultural  
Research Institute

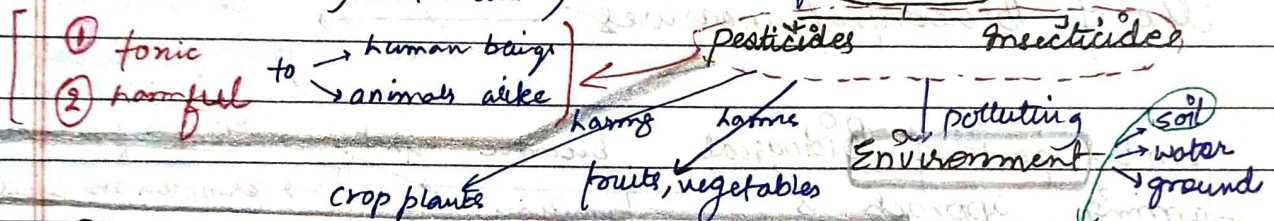
KVIC

Khadi & Village  
Industries Commission

## MICROBES AS BIOCONTROL AGENTS

Biocontrol  $\xrightarrow{\text{refers to}}$  Use of Biological agents for controlling  $\begin{cases} \text{plant diseases} \\ \text{Pests} \end{cases}$

\* In modern society these problems tackled by  $\uparrow$  use of chemicals



Biological Control of  $\begin{cases} \text{Pests} \\ \text{Diseases} \end{cases}$

In Agriculture  $\rightarrow$  there is method of controlling pests that relies on Natural Predation (rather than introducing chemicals)

\* Key belief of farmer  $\rightarrow$  Biodiversity furthers health.

\* More variety a landscape has, more sustainable it is.

Organic farmer  $\xrightarrow{\text{works to create a}}$  system where insects that are called pests sometimes are not eradicated.

Kept at manageable levels by complex system of checks  $\leftarrow$  but instead  $\rightarrow$  balances within a living & vibrant ecosystem.

contrary to "conventional" farming practice  $\rightarrow$  where chemicals are used to kill both  $\begin{cases} \text{useful} \\ \text{harmful forms} \end{cases}$  indiscriminately

Not good.



Biocontrol → holistic Approach that seeks to develop understanding of webs of interaction b/w myriad of organisms

Organic farmer <sup>holds</sup> <sub>views</sub> → eradication of creatures that are often described as pests is not possible, but also undesirable

would not be able to survive

Beneficial predators

parasites insects

which depend on them for food & hosts

Use of Biocontrol measures will greatly reduce dependence on toxic chemicals & pesticides

Imp. part of Biological farming approach is

become familiar with various life forms

that → inhibit field → predators and pests → their life cycle → patterns of feeding → habitats they prefer

this will develop appropriate means of biocontrol.

Ladybirds & Dragonflies control / rid of Aphids & mosquitoes

bacteria → available as in sachets as dried spores

Bacillus Thuringiensis → control

Butterfly caterpillars

mixed with water

sprayed on vulnerable plants

Brassica

Fruit trees

eaten by insects larvae

in gut of larvae toxin released & larvae gets killed

Bact. disease will kill the caterpillars, but leave other insects unharmed.



Bcz of development of methods of Genetic engineering in the last decade or so, the scientists have introduced *B. thuringiensis* toxic genes into plants.

Such plants → Resistant to attack by insect pests (Bt cotton example).

fungus Trichoderma (free living)

→ very common in Root system

→ effective biocontrol agents of several plant pathogens.

Baculovirus

→ are pathogens

→ Attack insects & other arthropods

Genus

Nucleopolyhedrovirus

→ excellent candidates for  
Narrow spectrum insecticides applications

② → species specific

no -ve impacts on

Plants

Mammals

Birds

Fish

Non target insects

desirable when

①

Beneficial insects are being conserved to aid in an overall Integrated Pest management (IPM)

②

OR  
when ecologically sensitive are to be treated

## MICROBES AS BIOFERTILISERS

Organic farming

enrich nutrient quality of soil

Use of Biofertilizers.

are that organisms

main source

Bacteria

Fungi

Cyanobacteria

\* Roots of leguminous plants formed by symbiotic association of Rhizobium

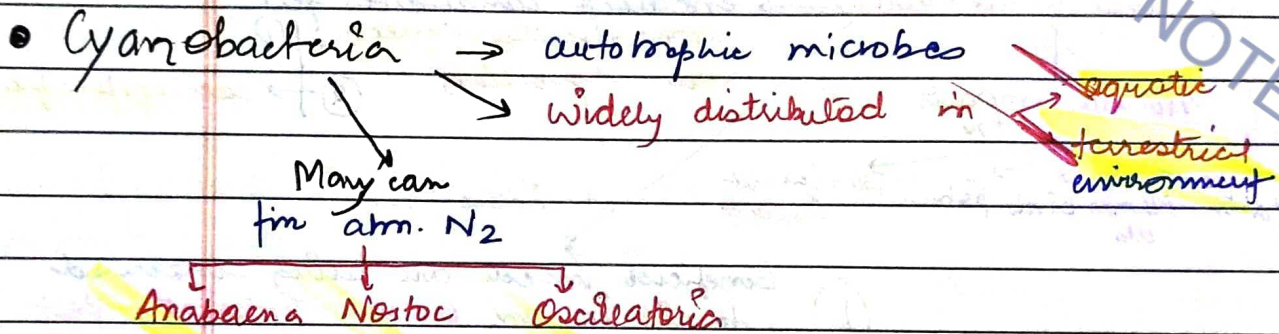
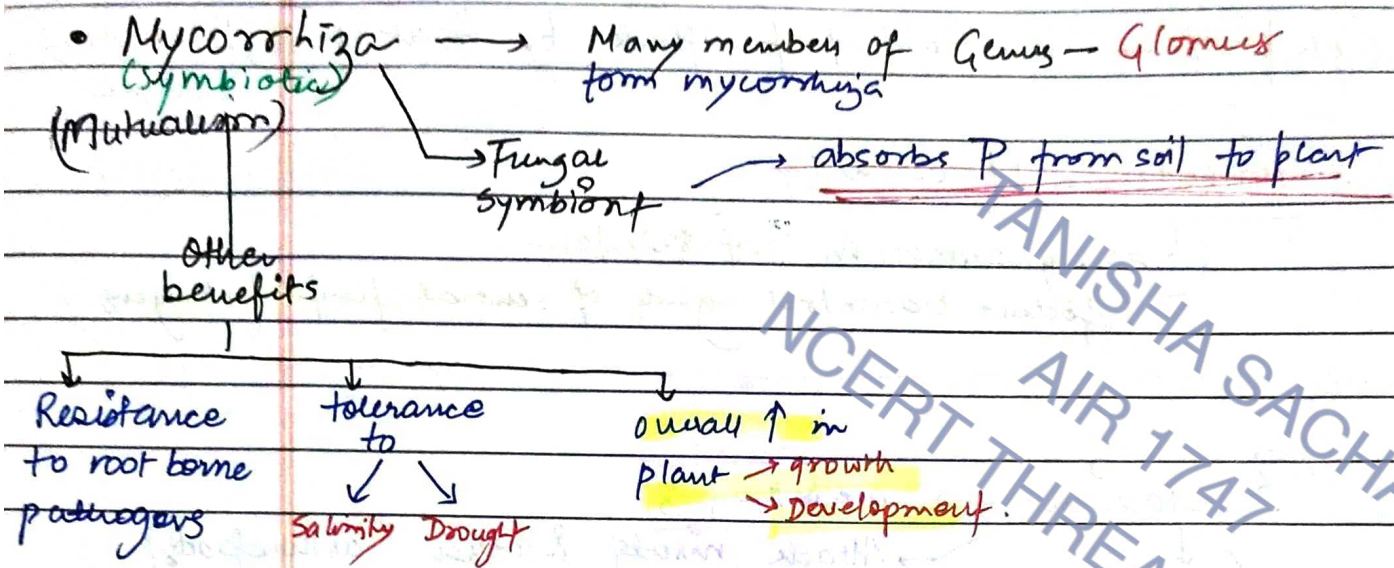
Nutrient

used by plants

fix atm. nitrogen into organic forms



- Bact that fix atm  $N_2$    
 free living in soil   
 }   
 Azospirillum   
 Azotobacter   
 } thus enriching nitrogen content of soil.



In Paddy field. → Cyanobacteria — imp. biofertilizer.

BCsA adds Organic matter to soil → ↑ fertility

Currently — In our country → a number of biofertilizers are available commercially in market

To replenish soil nutrients

Farmers use these regularly in their fields

Reduce dependence on chemical fertilizers